Abstract No. evan767

Direct Evidence For a Non-infinite Effective Diffusion Length of As in the Quaternary SAG Model

K.Evans-Lutterodt (Lucent) J. Ablett (Kings College, UK), C.Y.Kim (Northwestern), S.Ustin (Lucent), M.Hybertsen, C.C. Kao (NSLS)

Beamline(s): X16C

Introduction: Using X-ray microbeam techniques, we test directly one of the key assumptions of the Selective Area Growth (SAG) model. SAG of quaternary $In_{1-x}Ga_xAs_yP_{1-y}$ compounds is accomplished by patterning the InP substrate with an oxide pads and then growing the quaternary layer. The oxide pads perturb the local concentration of the four chemical species, and this results in a spatial variation of concentration and thickness. This spatial variation can be modeled by a species dependent effective diffusion length. It has been assumed that the effective diffusion length for As is infinite, which would imply no spatial variation.

Results: Shown in the Figure below, the solid dots are measurements of the As concentration, made by combining micro-fluourescence and thickness measurements from micro-diffraction, for different pad widths, scaled to the value far from any oxide pads. These measurements were performed at the synchrotron Beamlines X16C and X13 at Brookhaven. In the existing model, the best fit line would be independent of pad width, and the solid line would be parallel to the x-axis.

Conclusions: Using X-ray microbeam techniques, we have tested directly one of the key assumptions of the Selective Area Growth (SAG) model. While the model predicts no spatial variation of As in $In_{1-x}Ga_xAs_yP_{1-y}$ quaternary films, we show that there is in fact a weak spatial variation.